

*On the acquisition of alar appendages by the Spruce form of Chermes abietis-piceæ* MS. in the N.-W. Himalayas.—By E. P. STEBBING,  
F.L.S., F.E.S.

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In July 1893, Mr. Smythies, late Conservator of Forests, Central Provinces discovered the winged form of a species of *Chermes* issuing from galls or pseudo-cones (see fig. *d*) on spruce (*Picea Morinda*) trees at Deoban in the Jaunsar Forests of the N.-W. Himalayas (elevation 9,200 ft.) Mr. Smythies stated that only immature forms were to be found in the galls in May and June, the first winged individuals observed issuing on July 21st. These insects were identified by Mr. E. B. Buckton, F.R.S., as the species *Chermes abietis* of Linnæus and Kaltenbach.

The above facts are recorded in Indian Museum Notes, Vol. III, No. 5, the species being noted as new to the fauna of India. I can find no further mention or data about this insect.

In May, June, and a portion of July, in 1901, and the latter part of May, all June, and half of July, in 1902, the writer toured through the Jaunsar and Simla Hill Forests, and whilst observations were noted on the habits of other insects, many quite new to science, a careful study was made of the *Chermes*. The notes then recorded are still far from complete, but the important and interesting discovery was made that whereas, as in Europe, the insect spends one generation of its life in pseudo-cones upon the spruce (*Picea Morinda*), the individuals of the alternative generation of the parallel series live, not upon the larch as in Europe, since the tree is not to be found in the N.-W. Himalayan Forests, but upon the silver fir (*Abies Webbiana*). Owing to this habit I call the insect *Chermes abietis-piceæ*, MS., to distinguish it from the *Chermes abietis-laricis* of Europe. We shall here only concern ourselves with the acquisition of alar appendages and method of escape of the winged individuals from the galls found on the Spruce, leaving for a future paper full descriptions of the forms and habits of the other individuals of the parallel series of this most interesting insect.

As noted by Mr. Smythies, throughout June only small immature larvæ are to be found within the false cones. In the first week of May I have found the eggs, laid in patches on the bark of the twigs and main stem of the tree by the winter female, to be abundant. Little purple larvæ (see plate, fig. *a*) hatch out from these and slowly increase in size throughout the rest of May, June, and early days of July, by which date they become full-grown. An examination of the cone shows that even whilst still quite small it is partitioned off into chambers, figs. *e, f*, each con-

taining a number of the immature aphids. It differs, however, from the European one in the fact that it never has long portions of needles growing out of the centre of the diamond-shaped external portion of the covering of each chamber. It would appear as if the gall arising from the attacks of the larvæ of the *Chermes abietis-piceæ* was almost a stem growth and not a leaf one. And yet this is in all probability not the case. In the European form the formation of the gall is attributed to the young larvæ feeding at the bases of the young needles causing them to swell up at this point and coalesce, the upper part of the needle still continuing its growth. Thus the external covering of each chamber has the upper portion of a spruce needle, perhaps half an inch or more in length, growing out of its centre. No such long upper growth of needle is found in the Himalaya gall; but at times the centre of each diamond-shaped cover bears a tiny green spike which appears undoubtedly to be the upper extremity of the needle and thus proves that the gall arises in a similar manner to the European one. This point will be dealt with more fully in a subsequent paper. In fig. *d* a branch is shown bearing a typical set of the pseudo-cones containing nearly mature larvæ as they are invariably found in the N.-W. Himalayas. Fig. *f*, shows an old last year's cone from which all the insects have escaped.

The year 1902 was a dry warm one up in the Himalayan region and therefore favourable to insect growth and development. Galls in sunny warm spots were found to be opening on the 10th July. The gall or false cone, in the process of what may perhaps be termed 'ripening,' changes from green to pale crimson; this takes place first on one side, after the manner of a ripening apple, and then all over, the cone often becoming bright crimson for a time, finally turning, when the insects are ready to emerge, a dull purple with the exception of a small patch or point in the centre of each of the diamond-shaped covers (where the needle would arise from in the European Spruce gall) which remains bright green.

The cone does not necessarily commence opening at the top: the small chambers may open anywhere all over it. The portions more exposed to the sun and in direct contact with warm air currents ripen first. An examination of the insects within the galls, just before the latter begin to open, will show them to be little thickish, puffy, wingless aphids, dull purple in colour and much ridged dorsally with greatly enlarged globose anterior coxæ. Beneath the skin at each side of the mesothorax a small dull yellow excrescence can be seen and posterior to this, on the metathorax, also at either side, a dark longish, flatter protuberance. Legs and antennæ are yellowish-green. Antennæ are six-jointed. Length 2.35 mm. Fig. *b*, shows this fully grown larva.

This is the last stage of development of the insect within the gall, no functional alar appendages being present.

In opening the upper two edges or sides of the diamond-shaped outer covering of the chamber become detached at their points of juncture with the two lower sides of the cover of the chamber next above, thus forming a kind of lip, which can be forced open with forceps. The external surfaces of the diamond-shaped coverings then contract slightly, thus causing the aperture to permanently gape, the opening becoming wider and wider as the surface dries and consequently contracts (fig. *f*). The slit is at first quite narrow, but as soon as it appears the insects commence to crawl out. On reaching the outside of the false cone the fat purple larva at once undergoes its last moult. In doing this, the skin splits down a median line, both dorsally and ventrally; as far as the mesothorax dorsally, and the first or second pair of coxæ ventrally; the insect then slowly crawls out leaving the white papery cast skin, to which are attached the dark-coloured leg and antennal cases, behind it.

After this last moult it will be seen that the *Chermes* has undergone a great change.

It now appears as a small gorgeously-coloured aphid, with black shining head and prothorax, dark orange-brown shining meso- and meta-thorax, both dorsally and ventrally, and with a shining black abdomen. Legs and antennæ bright canary yellow. On either side of the thorax two little bright-coloured bundles are visible, a bright naples yellow anteriorly and vivid apple-green posteriorly. The whole insect, in fact, is very highly coloured and looks at this stage as if it had just been freshly painted with the very brightest tints in Nature's colour box and then given a coating of varnish. As soon as the *Chermes* has freed itself from the last attachment of its last skin it begins to crawl actively about on the exterior surface of the gall and the little yellow and green bundles unfold and disclose the fact that they are the rolled-up alar appendages. As far as I could perceive, the insects themselves take no active part in unfolding these wings. They do not hang themselves up to get them unrolled as is the case with *Lepidoptera*, but simply walk about and under the influence of the sun and heat, the wings rapidly spread out, stiffen, and become functional. I noted that in many cases, even before the insect has entirely freed itself from the last larval skin, the little bundles had so far unrolled as to be quite distinct from one another. Within half an hour from the time of leaving the cone, the wings are fully unrolled, being held at an angle on the side of, but not meeting in a roof-shaped manner over, the abdomen. These wings are pale apple-green in colour with yellow nervures except at their juncture with the thorax where they are chrome-yellow.

Total length of insect with wings is 4.68 mm. The wings project beyond the posterior end of the body about  $1\frac{1}{4}$  times the total length of the aphid. The *Chermes* is short, thickish, almost squarish in build and appears somewhat flatter after its final moult. The head is small; antennæ six-jointed, the first joint very small, second and third small, fourth longest; prothorax broad and much channelled; the rest of thorax also broad the metathorax being sessile upon the abdomen. Fig. e, shows a dorsal and side view of the winged form.

Within one and a half hours of shedding the last skin, patches of white setæ begin to appear upon the aphid, and the meso- and meta-thorax turn from orange to shining black. These hirsute white patches appear on the head, upon each division of the thorax, and two little tufts, set side by side on each segment, run medianly down the dorsal surface of the abdomen. On the prothorax these white setæ are in a transverse ridge; on the meso- and meta-thorax they are in two large patches as on the abdomen. The wings become a paler green, the costal and median nervures being strongly marked and orange in colour, the transverse intersecting ones being silvery.

The insect by now, *i.e.*, within three hours of its last moult, has lost all its brilliant colouring and has become dull and inconspicuous. It only differs from the winged form to be found at this period on the needles of the silver fir in having a green tinge in the wings, those of the silver fir fly being colourless but iridescent in certain lights.

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